



## MEDIATING ROLE OF KNOWLEDGE SHARING ON INFORMATION TECHNOLOGY AND INNOVATION

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### ABSTRACT

**Purpose:** *The purposes of this paper are to examine the relationships among the information technology, knowledge sharing and firm's innovation, and while the knowledge sharing as mediating effect is also simultaneously investigated on the relationship between information technology and firm's innovation.*

**Design/methodology/approach:** *In this research, the quantitative method was mainly employed. First, the research model was constructed by the literature review process. Then, the hypotheses were launched and tested by the survey method. The questionnaires were used as the tool in collecting data. A total of 224 questionnaires from the herbal manufacturing companies were considered. Multiple regression and Bootstrapping method were employed to test these hypotheses.*

**Findings:** *The finding showed that the information technology has positively influences on both knowledge sharing and innovation. With regard to knowledge sharing, the findings showed that it has positively influence on innovation, while it also has positively mediated influence on the relationship between information technology and firm's innovation.*

**Research limitation/implications:** *Data collection of this study was primary focused on herbal manufacturing industry. Collecting data of variety industries would gain more understanding of this relationship. Furthermore, other factors or variables should also investigate in order to understand their effect on innovation.*

**Originality/value:** *This paper demonstrated that the knowledge sharing and information technology had the critical influence on the organization innovation and played a vital role as a critical success factor of organization.*

**Keywords:** Knowledge sharing, innovation, information technology

### INTRODUCTION

Knowledge is a basis of competitive advantage of firm. Knowledge can be created, recognize, archive, access, and apply by the persons within firm (Nonaka, 1995). This organizational knowledge is usually flowed and distributed within the firm. Moreover, the multiple knowledge is required in order to improve products or services of organization (Lee, 2001).

In particular, the organization knowledge can be created from such past learning, experience, and acquiring new information and knowledge of each individual. Then, sharing knowledge of individual with others will increase the ability to solve problem (Nonaka et al., 2006) and enhance the innovation capability of firm (Lee, 2001; Sáenz et al., 2009). Moreover, the firm cannot survive without explicit or tacit knowledge; both types of knowledge should be integrated and simultaneously performed as Hiroshi Okuda, the chairman of Toyota mentioned that *"The strength of Japanese manufacturing industries are at the technology (based on) tacit knowledge. With the progress in Information Technology (IT), tacit*

*knowledge is converted into explicit knowledge. Still, we need tacit knowledge. To build a car, we have to educate people.”*. In addition, this also indicated the need of IT in the supporting organizational knowledge creation process within firm, as information technology is a supporting factor of organization structure to enhancing organizational performance.

In this research, the herbal industry is focused. It can be said that Thailand is rich in a variety of herbs. As we can see from such increasing the amount of new herbal products has enter to the market, and the trend of herbal consumers has also increased. Moreover, nowadays the herbal industry in Thailand has rapidly growth and is becoming popular. According to the report of Ministry of Industry, Thailand, the amount of herbal manufacturers has continuously increase, which about 23 percent since 2004 to 2012. The creation of innovative products is an important matter of herbal industry. The main focus of the herbal industry is to reduce time-to-market and launch their own unique product. Moreover, the herbal industry has unique characteristics such as a high cost of R&D investment in developing product, and a highly regulatory environment (AmpolMitrivej). Currently, most herbal manufacturers develop the product formulations by themselves and keeps them as a secret, so as to the organization knowledge such knowledge and experience of personnel are the most value to the firm. In addition, almost of herb products in Thailand has been developed by an incremental innovation.

The organization aspect, which may be able to support in increasing innovation performance, is knowledge sharing among individuals within firm. Knowledge sharing can bring a lot of benefits to the firm such as faster speed in creating new innovative products or services. Therefore, the purposes of this research aim to;

- To investigate the relationships among knowledge sharing, information technology, and innovation.
- To identify the mediating effect of knowledge sharing on these relationships.

The next sections of this paper are organized as follows, Section 2 describes the relevant literature review, Section 3 develops the research model and launches the hypotheses for testing, Section 4 presents the research methodology and data collection procedure, Section 5 reports the data analyzing and the results, and Section 6 discusses the results, conclusion, limitation of this study, and further research directions.

## **LITERATURE REVIEW**

### **Knowledge sharing**

In an era of competition, one of the most important intangible assets of organization is the knowledge instead of capital and labor. Nonaka et al. (2006) mentioned that knowledge is a key success factor of organization. The organizations must adopt themselves in order to gain the competitive advantage and survival in a fiercely competitive global economy.

There are much earlier scholar defined the definition of knowledge in many different ways, however, there is no consensus about its characteristics (King, 2009). Two common types of knowledge in knowledge management area consist of explicit and tacit knowledge. First, the explicit knowledge refers to the knowledge that can be easily articulated, expressed in words and numbers, and can be easily stored into repositories, communicated, and reproduced. Second, the tacit knowledge refers to the knowledge that is difficult to articulate, hard to



transfer to others, and based on the experiences and commitments of person. (Nonaka, 1994; Polanyi, 1966)

In the managing knowledge resource becomes an essential issue in developing organization in order to gain and sustain a competitive advantage (Davenport, De Long, & Beers, 1998). Organization knowledge is usually occurred and distributed within organization. Moreover, to improve the products, services, or organizational performance, it requires the multiple knowledge sources. The integration of knowledge can be occurred from the sharing of individual knowledge.

Knowledge sharing is defined as “activities of transferring or disseminating knowledge from one person, group or organization to another” (Lee, 2001, p.324). Moreover, the knowledge sharing can bring the benefits to organization if individuals are willing to share (Nonaka, 1995). One benefit of knowledge sharing has directly effect to organizational performance which is innovation. In another word, knowledge sharing is an ingredient of innovation process. Moreover, it provides other benefits to organization such as increase intellectual capital of organization, interchange between individual competitiveness to organizational competitiveness, and reduce organizational cost of employee’s gathering knowledge. (Zhang et al., 2005)

### **Information Technology**

During the past decade, much literature in information technology has demonstrated the importance of information technology for improving organization performance. Information technology is a supporting factor of organization factor that increase organizational innovation and performance. Yang and Chen (2007) suggest four main factors of organization level, which has effected on the knowledge sharing. These consist of culture, structure, people, and technology. In technological aspects, they identified that IT infrastructure is the most important factor, and followed by IT know-how, and IT-support. Moreover, Hsu (2006) suggested three approaches that are used to enhance employees’ knowledge sharing within organizations: 1) a technology-based approach 2) an incentive-based approach and 3) an organizational-based approach. In a technology-based approach is required such an information technology to support an individual to share their knowledge within organization.

Furthermore, There are two basic approaches to knowledge management forwhich IT can providesupport: codification andpersonalization(Hansen et al., 1999). The codification approach: more explicit and structured knowledge iscodified and stored in knowledge bases. The main role of IT here is to help people to share knowledge through common storage so as to achieve economicreuse of knowledge. e.g. IT tools is electronic knowledge respositories.The personalization approach: more tacit and unstructured knowledge isshared largely through direct personal communication. The main role of IT is to help people locate each other and communicate so as toachieve complex knowledge transfer. e.g. IT tools are knowledge expertdirectories and video conferencing tools.Both are fundamental to understanding the role of information technology in knowledge management.

## Innovation

Simple explanation, innovation is the introduction of something new (Davenport, 1993). More explanation such as The Oslo Manual (2005) identified that “innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations”. Most innovation definitions are focused on improvement within the organization in order to meet their business goals.

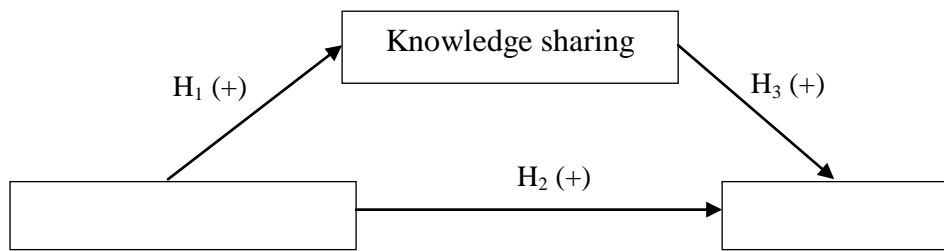
The type of innovation can be categorized into various types. For instance, Tidd et al. (2005) focused on the pathway to examine when creating the innovation. The type of innovation has categorized into four types or can be called 4Ps of innovation. These consist of 1) Product innovation: changes in the things (products/services) which an organization offers; 2) Process innovation: changes in the ways in which they are created and delivered; 3) Position innovation: changes in the context in which the products/services are introduced; 4) Paradigm innovation: changes in the underlying mental models which frame what the organization does. Moreover, the Oslo Manual (2005) categorized innovation into four types which consisted of product innovation, process innovation, market innovation, and organization innovation.

## THE RESEARCH MODEL AND HYPOTHESES

The research model was constructed following earlier relevant literature as shown in Figure 1. It shows the research model with all variables. Moreover, it illustrates the relationships among knowledge sharing, information technology, and innovation. Four research hypotheses of this study were generated to test the relationships among knowledge sharing, information technology, and innovation, and the mediating effect of knowledge sharing on the relationship between information technology and firm's innovation.

Moreover, to establish the mediating role of knowledge sharing, four hypotheses were proposed according to Baron and Kenny, 1986, p.1177;

*“First, the independent variable must affect the mediator in the first equation; second, the independent variable must be shown to affect the dependent variable in the second equation; and third, the mediator must affect the dependent variable in the third equation. If these conditions all hold in the predicted direction, then the effect of the independent variable on the dependent variable must be less in the third equation than in the second. Perfect mediation holds if the independent variable has no effect when the mediator is controlled.”*



**Figure 1**The research framework

Therefore, the hypotheses were established follow the Baron and Kenny (1986) and the earlier relevant literature as follow:

### **Information technology and knowledge sharing**

Information technology is an essential administrative support function, and can increasing the competitive advantage in the firm. Information technologies can not only improving the firm performance, but also supporting knowledge sharing among individuals within firm. For example, Bakhari and M (2010) investigated the influence of technological factors which included information technology infrastructure, know-how, and tools on knowledge sharing quality of government officers in Malaysia. The results showed that information technology know-how such training employees in IT is the most important variables in increasing knowledge sharing quality, followed by infrastructure, and tools. Moreover, much literature argued that IT can support employee's knowledge sharing. Aulawi et al. (2008) described that IT is one of important factor and has directly effect on knowledge sharing behavior of employees. In addition, IT can support the sharing behavior of informal knowledge of employees as well (Davison et al., 2013). Therefore, we proposed the following hypothesis:

*H1: Information technology has positively influence on employee's knowledge sharing.*

### **Information technology and innovation**

Huang et al. (2009) the level of firm's innovation can be improved by information synergy and IT capability. Bartel et al. (2007) explained that the investment in new information technology in manufacturing firm will valuable thing such increasing the productivity growth, and the product innovation performance. However, the worker skill in IT should simultaneously improve. Therefore, we proposed the following hypothesis:

*H2: Information technology has positively influence on firm's innovation.*

### **Knowledge sharing and innovation**

Most of earlier literature agreed that the knowledge sharing has influence on innovation. Wang and Wang (2012) pointed out that explicit and tacit knowledge sharing; both have directly influence on firm innovation and performance. Explicit knowledge sharing has more influences on innovation speed while tacit knowledge has more influences on innovation quality. Furthermore, Saenz et al. (2012) focused on the effect of knowledge sharing mechanism on innovation capability. Then, the results indicated that personal-interaction

based knowledge sharing initiatives was the most influential one, and ICT-based knowledge sharing initiatives and knowledge sharing embedded in management processes were respectively significant. Moreover, Liao et al. (2007) argued that knowledge sharing plays an important role in developing firm's innovation. In addition, knowledge must be absorbed and then share between employees with the purpose of increasing firm's innovative capability and benefit to the firm. Thus, we proposed the following hypothesis:

*H3: Knowledge sharing has positively influence on firm's innovation.*

Lastly, the mediating role of knowledge sharing in the relationship between information and firm's innovation was also test in the last hypothesis. Then, we propose the following hypothesis:

*H4: Knowledge sharing is a mediator between information technology and firm's innovation.*

## **RESEARCH METHOD AND DATA COLLECTION**

### **Measurement development**

In this study, the measured items of all variables in the research model were primary adopted from the relevant earlier researches. These included three major variables which were information technology, knowledge sharing, and firm's innovation.

### **Data collection procedure**

The quantitative method was employed in this study. The questionnaires were used as the data collection tool. The questionnaires in Thai version were distributed to the herbal industry from November, 2012 to January, 2013. There were totally 224 usable questionnaires.

### **Reliability Test**

The questionnaire design was primarily based on the literature review. The questionnaire were measured the internal consistence reliability based on the Cronbach's alpha coefficient technique. The results indicated that the Cronbach's alpha coefficient of knowledge sharing, information technology and firms' innovation were 0.739, 0.762, and 0.716, respectively, which were above the acceptable level, 0.7. This indicated that each measured items of questionnaire had a high internal consistence.

### **Measurement**

In this study, all of the measured items were adopted from earlier research. These consisted of 3 constructs which were knowledge sharing, information technology, and innovation. Moreover, a five-point Likert scale, which ranged from "1 = strongly disagree" to "5 = strongly agree", was employed to measure all items.

## DATA ANALYSIS AND RESULT

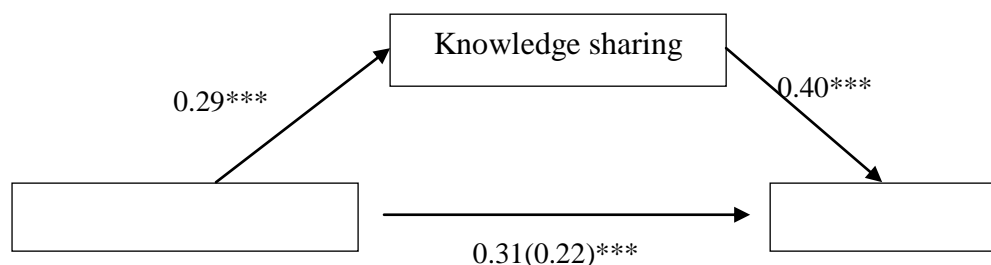
The results of this research found that the relationship between the independent variable, information technology, and the mediating variable, knowledge sharing was positive and significant. Moreover, the relationship between the dependent variable, innovation and the mediating variable, knowledge sharing was positive and significant as well. Therefore, the results of hypotheses testing were following;

H1 presented that the relationship between information technology and knowledge sharing. The results showed that the information technology is positively and significantly ( $\beta = 0.2984$ ,  $t(222) = 6.4397$ ,  $p < 0.001$ ) related to knowledge sharing.

H2 presented that the relationship between information technology and firm's innovation. The results showed that the information technology is positively and significantly ( $\beta = 0.3135$ ,  $t(222) = 9.2709$ ,  $p < 0.001$ ) related to the firm's innovation.

H3 presented that the relationship between knowledge sharing and knowledge firm innovation. The results showed that the information technology is significantly ( $\beta = 0.4019$ ,  $t(222) = 8.9388$ ,  $p < 0.001$ ) related to the firm's innovation.

Moreover, both H<sub>1</sub> and H<sub>2</sub> were significant, mediation analyzes were test by using the bootstrapping method with bias corrected confidence estimates (Preacher and Hayes, 2004). In this study, the 95% confidence interval of the indirect effects was obtained with 5,000 bootstrap resamples (Preacher and Hayes, 2008). The H<sub>4</sub> was tested and the results of mediation analysis confirmed that the mediation role of knowledge sharing in the relationship between information technology and firm's innovation. ( $\beta = 0.218$ , CI= 0.0827 to 0.1695). In addition, it indicated that the knowledge sharing provided a partial mediation effect between information technology and firm's innovation. The results of hypotheses testing were shown in Figure 2.



Note: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Figure 2** Indirect effect of knowledge sharing on the relationship between information technology and firm's innovation



## **DISCUSSION AND IMPLICATION**

This study aims to develop a framework for examining knowledge sharing, information technology, and innovation. The research samples were from herbal manufacturers' employees in Thailand. Moreover, the knowledge sharing, information technology, and innovation were focused on in this study.

The results showed that information technology had positively influenced on knowledge sharing. The results of this study were consistent with the earlier relevant researches (Aulawi et al., 2008; Bakhari and M, 2010; Davison et al., 2013). Besides, the information technology had positively influenced on firm's innovation. The results of this study were consistent with the earlier relevant researches such Huang et al. (2009) and Bartel et al. (2007). In addition, much earlier researches provided a strong relationship between knowledge sharing and firm's innovation such as (Liao et al., 2007); (Saenz et al., 2012); and (Wang and Wang, 2012). The results of this study also indicated that the knowledge sharing had a significant positive influence on firm's innovation. Furthermore, the results indicated that the knowledge sharing was a partial mediator between information technology and firm's innovation. It means that it is not only indirect predict to firm's innovation, it could also supported the information technology influence on firm's innovation.

In case of herbal manufacturing in Thailand, the innovativeness is a key in driven business and competitiveness. Both public and private organizations provided the supporting to herbal manufacturers in order to develop their innovation such as The National Innovation Agency, Thailand. The resulted indicated that most herbal manufacturers focused on their product innovation rather than process innovation. Moreover, most of them had developed their products as the incremental innovation due to some constraints such as high cost in R&D investment and inadequate experts. To develop organization innovation, it requires the multiple source of knowledge. This is not only explicit knowledge, but also tacit knowledge such employee's experience becomes an essential knowledge of organization. The ability of changing tacit knowledge to explicit knowledge and sharing this knowledge with others will be the most valuable to organization. This indicated that the knowledge sharing of employees plays an important role in organization. Moreover, in this study, it indicated that the employees in herbal manufacturer had shared their explicit knowledge rather than tacit knowledge. However, their tacit knowledge could mostly share by training program.

In addition, the information technology becomes an organization factor in increase knowledge sharing and firm innovation. In this study, we found that many herbal manufacturers had emphasized on the information technology issue, however, they focused on the information technology infrastructure rather than the information knowledge of employees. For example, some manufacturers provided the LAN system, and intranet to share their information and knowledge within organization. Moreover, some of them invested in the videoconference system to communicate within organization. Furthermore, some of them preferred to communicate with their employees and customers via social network. However, there are not much organization where had provided training course in information technology to employees. Therefore, organization should provide the effective system of information technology infrastructures, and the knowledge of employees in information technology should be improved such as providing training course to increase knowledge





sharing of employees in the organization and increase the product and process innovation of firm.

### LIMITATIONS AND FUTURE RESEARCH

In this research, there are some unavoidable limitations. First, this research was conducted only on a small size of respondents who were the staff level, which might not represent all employees in the firms. Then, to generalize the results for larger groups, the study should have involved more respondents at different levels. Second, this study only focused on the herbal manufacturers, further research could focus on other industry or compare between different industries. Finally, some other relevant variables might be added to the research model and their relationships should be investigated in the future as well.

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### REFERENT

1. Aulawi, H., Sudirman, I., Suryadi, K., and Govindaraju, R. (2008). Knowledge sharing behavior, antecedent and its influence towards the company's innovation capability. In "IEEE International Conference on Industrial Engineering and Engineering Management, 2008. IEEM 2008", pp. 2092-2096.
2. Bakhari, M., and M, Z. (2010). The Contribution of Technological Factors on Knowledge Sharing Quality among Government Officers in Malaysia. In "Knowledge Management" (P. Virtanen and N. Helander, eds.). InTech.
3. Bartel, A., Ichniowski, C., and Shaw, K. (2007). How does information technology affect productivity? Plant-level comparisons of product innovation, process improvement, and worker skills. *The quarterly journal of Economics***122**, 1721-1758.
4. Davenport, T. H. (1993). "Process innovation: reengineering work through information technology," Harvard Business School Press, Boston, Mass.
5. Davison, R. M., Ou, C. X. J., and Martinsons, M. G. (2013). Information technology to support informal knowledge sharing. *Information Systems Journal***23**, 89-109.
6. Development, O. f. E. C.-o. a., and Communities, S. O. o. t. E. (2005). "Oslo manual: guidelines for collecting and interpreting innovation data," OECD Publishing.
7. Hansen, M. T., Nohria, N., and Tierney, T. (1999). What's your strategy for managing knowledge? *Harvard Business Review***77**, 106-116, 187.
8. Hsu, I.-C. (2006). Enhancing employee tendencies to share knowledge-Case studies of nine companies in Taiwan. *Int. J. Inf. Manag.***26**, 326-338.
9. Huang, Y.-H., Li, E. Y., and Chen, J. S. (2009). Information synergy as the catalyst between information technology capability and innovativeness: empirical evidence from the financial service sector.
10. King, W. R. (2009). "Knowledge Management and Organizational Learning," Springer.
11. Lee, J.-N. (2001). The impact of knowledge sharing, organizational capability and partnership quality on IS outsourcing success. *Information & Management***38**, 323-335.
12. Liao, S. h., Fei, W. C., and Chen, C. C. (2007). Knowledge sharing, absorptive capacity, and innovation capability: an empirical study of Taiwan's knowledge-intensive industries. *Journal of Information Science***33**, 340-359.
13. Nonaka, I. (1995). "The Knowledge-Creating Company," Harvard Business Press.



14. Nonaka, I., Von Krogh, G., and Voelpel, S. (2006). Organizational Knowledge Creation Theory: Evolutionary Paths and Future Advances. *Organization Studies***27**, 1179-1208.
15. Preacher, K., and Hayes, A. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers***36**, 717-731.
16. Preacher, K., and Hayes, A. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior research methods***40**, 879-891.
17. Saenz, J., Aramburu, N., and Blanco, C. (2012). Knowledge sharing and innovation in Spanish and Colombian high-tech firms. *Journal of Knowledge Management***16**, 5-5.
18. Sáenz, J., Aramburu, N., and Rivera, O. (2009). Knowledge sharing and innovation performance: A comparison between high-tech and low-tech companies. *Journal of Intellectual Capital***10**, 22-36.
19. Tidd, J., Bessant, J. R., and Pavitt, K. (2005). "Managing innovation: integrating technological, market and organizational change," John Wiley and Sons.
20. Wang, Z., and Wang, N. (2012). Knowledge sharing, innovation and firm performance. *Expert Systems with Applications***39**, 8899-8908.
21. Yang, C., and Chen, L.-C. (2007). Can organizational knowledge capabilities affect knowledge sharing behavior? *Journal of Information Science***33**, 95-109.
22. Zhang, L., Li, J., and Shi, Y. (2005). Study on improving efficiency of knowledge sharing in knowledge-intensive organization. In "Proceedings of the First international conference on Internet and Network Economics", pp. 816-825. Springer-Verlag.